CONTINUUM RADIATIVE HEAT TRANSFER MODELING IN MEDIA CONSISTING OF OPTICALLY DISTINCT COMPONENTS IN THE LIMIT OF GEOMETRICAL OPTICS

W. Lipiński[*], D. Keene[*], S. Haussener[**], and J. Petrasch[***]
[*]Department of Mechanical Engineering, University of Minnesota, Minneapolis, MN 55455, USA
[**]Department of Mechanical and Process Engineering, ETH Zurich, 8092 Zurich, Switzerland
[***]Department of Mechanical and Aerospace Engineering, University of Florida, Gainesville, FL 32601, USA

ABSTRACT. Continuum-scale equations of radiative transfer and corresponding boundary conditions are rigorously derived for a general case of a multi-component medium consisting of arbitrary-type, non-isothermal and non-uniform components in the limit of geometrical optics. The link between the discrete and continuum scales is established by volume averaging of the discrete-scale equations of radiative transfer by applying the spatial averaging theorem. Precise definitions of the continuum-scale radiative properties are formulated while accounting for the radiative interactions between the components at their interfaces. Possible applications and simplifications of the presented general equations are discussed.